

What is claimed is:

1 1. A method of evaluating the porosity characteristics of a sample of material having a
2 plurality of pores using a porosimeter comprising a pressurizable sample chamber
3 for holding the sample, a membrane located at a bottom of the sample chamber and
4 having a plurality of pores, wherein the membrane pores have a size smaller than
5 any of the sample pores of interest, a fluid reservoir located below the membrane,
6 and a fluid displacement reservoir, comprising the steps of:

7 a) placing the sample in the sample chamber, on the membrane;

8 b) wetting the sample with a fluid until the fluid has entered substantially all of the
9 pores in the sample and the membrane;

10 c) applying a pressure in the sample chamber which is greater than a bubble point
11 pressure of the sample, but less than a bubble point pressure of the
12 membrane, such that as fluid enters the fluid reservoir through the
13 membrane, it displaces fluid already in the fluid reservoir into the fluid
14 displacement reservoir;

15 d) pumping the displaced fluid back into the fluid reservoir along a bottom of the
16 membrane such that air bubbles stuck to the membrane are swept away
17 from the membrane; and

18 e) measuring a weight change in the fluid displacement reservoir after a weight in
19 the fluid displacement reservoir reaches an equilibrium.

1 2. The method of claim 1, wherein the fluid is a fluid with high air diffusivity.

1 3. The method of claim 2, wherein the fluid is water.

1 4. The method of claim 1, further comprising the step of calculating a pore volume of the
2 sample using the fluid weight change measured in step (e).

1 5. The method of claim 1, wherein the pump is a peristaltic pump.

1 6. The method of claim 1 in which the step of wetting the sample further comprises
2 applying pressure at greater than the bubble point of the sample to force fluid into
3 the pores of the sample.

1 7. An improved method of evaluating the porosity characteristics of a sample of material
2 having a plurality of pores, using a porosimeter comprising a pressurizable sample
3 chamber for holding the sample, a membrane located at a bottom of the sample
4 chamber and having a plurality of pores, wherein the membrane pores have a size
5 smaller than any of the sample pores of interest, a fluid reservoir located below the
6 membrane, and a fluid displacement reservoir, wherein a wetted sample is
7 subjected to a pressure in the sample chamber which is greater than a bubble point
8 pressure of the sample, but less than a bubble point pressure of the membrane, such
9 that as fluid enters the fluid reservoir through the membrane, it displaces fluid
10 already in the fluid reservoir into the fluid displacement reservoir, wherein the
11 improvement comprises:

12 recirculating the displaced fluid through the fluid reservoir along the membrane
13 such that air bubbles stuck to the membrane are swept away from the
14 membrane.

15 8. The method of claim 7, wherein the fluid is a fluid with high air diffusivity.

1 9. The method of claim 8, wherein the fluid is water.

1 10. The method of claim 7, further comprising the step of calculating a pore volume of the
2 sample using the fluid weight change in the fluid displacement reservoir.

1 11. The method of claim 7, wherein the pump is a peristaltic pump.

1 12. A porosimeter for evaluating the porosity characteristics of a sample of material
2 having a plurality of pores comprising:

3 a) a pressurizable sample chamber for holding the sample, comprising a membrane
4 located at a bottom of the sample chamber and having a plurality of pores,
5 wherein the membrane pores have a size smaller than any of the sample
6 pores;

- 7 b) a fluid reservoir located below the membrane, comprising an inlet and an exit
 8 for fluid, such that as fluid enters the fluid reservoir through the membrane
 9 or the inlet, it displaces fluid already in the fluid reservoir through the exit;
- 10 c) a fluid displacement reservoir comprising an inlet and an exit, wherein the inlet
 11 receives the fluid displaced from the fluid reservoir; and
- 12 d) a recirculation line that receives fluid from the exit of the fluid displacement
 13 reservoir and circulates the fluid through the inlet of the fluid reservoir and
 14 along the membrane such that air bubbles stuck to the membrane are swept
 15 away from the membrane.

1 13. The porosimeter of claim 12, further comprising a balance for measuring weight
 2 change of the fluid displacement reservoir continuously as the fluid moves
 3 continuously through the displacement reservoir.

1 14. The porosimeter of claim 12, further comprising a fluid having high air diffusivity.

1 15. The porosimeter of claim 14, wherein the fluid is water.

1 16. The porosimeter of claim 12, wherein the porosity characteristic being evaluated is the
 2 pore volume of the sample.

1 17. The porosimeter of claim 12, further comprising a pump connected to the
 2 recirculation line, wherein the pump aids in circulation of the fluid.

1 18. The porosimeter of claim 17, wherein the pump is a peristaltic pump.

1 19. An improved porosimeter for evaluating the porosity characteristics of a sample of
 2 material having a plurality of pores of the type comprising a pressurizable sample
 3 chamber for holding the sample, a membrane located at a bottom of the sample
 4 chamber and having a plurality of pores, wherein the membrane pores have a size
 5 smaller than any of the sample pores of interest, wherein the improvement
 6 comprises:

- 7 a) a fluid reservoir located below the membrane, comprising an inlet and an exit
8 for fluid, such that as fluid enters the fluid reservoir through the membrane
9 or the inlet, it displaces fluid already in the fluid reservoir;
- 10 b) a fluid displacement reservoir comprising an inlet and an exit, wherein the inlet
11 receives the fluid displaced from the fluid reservoir; and
- 12 c) a recirculation line that receives fluid from the exit of the fluid displacement
13 reservoir and circulates the fluid through the inlet of the fluid reservoir and
14 along the membrane such that air bubbles stuck to the membrane are swept
15 away from the membrane.
- 1 20. The porosimeter of claim 19, further comprising a balance for measuring weight
2 change of the fluid displacement reservoir after a weight in the fluid displacement
3 reservoir reaches an equilibrium.
- 1 21. The porosimeter of claim 19, further comprising a fluid having high air diffusivity.
- 1 22. The porosimeter of claim 21, wherein the fluid is water.
- 1 23. The porosimeter of claim 19, wherein the porosity characteristic being evaluated is the
2 pore volume of the sample.
- 1 24. The porosimeter of claim 19, further comprising a pump connected to the recirculation
2 line, wherein the pump aids in circulation of the fluid.
- 1 25. The porosimeter of claim 24, wherein the pump is a peristaltic pump.